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ABSTRACT

Designed to develop creativity in young learners, this book contains interdisciplinary activities which focus on the theme of the moon. Activity pages are provided that can serve as front and back covers of a student booklet and the suggested activities can be duplicated for insertion between the covers resulting in a booklet for each student. A teacher/parent guide is included and supplies background information, activity descriptions, materials needed, and possible answers for the activities. A variety of exercises are provided on topics such as: (1) using the moon to tell time; (2) observing the moon's phases; (3) identifying features of the moon; (4) recognizing other planet's moons; and (5) decision-making, problem-solving simulation. (ML)

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YOUNG SCIENTISTS EXPLORE

The Moon

ED280705

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YOUNG SCIENTISTS EXPLORE

THE MOON

Book 3 -- Intermediate Level

by **JERRY DEBRUIN**

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MOON MESSAGE: A Note To Teachers and Parents &... A Moon Guide With Answers To Selected Activities.

Dear Friends:

Thank you for the many kind comments about my previous book, *Creative, Hands-on Science Experiences* (CHOSE) published by Good Apple, Inc., in 1980.

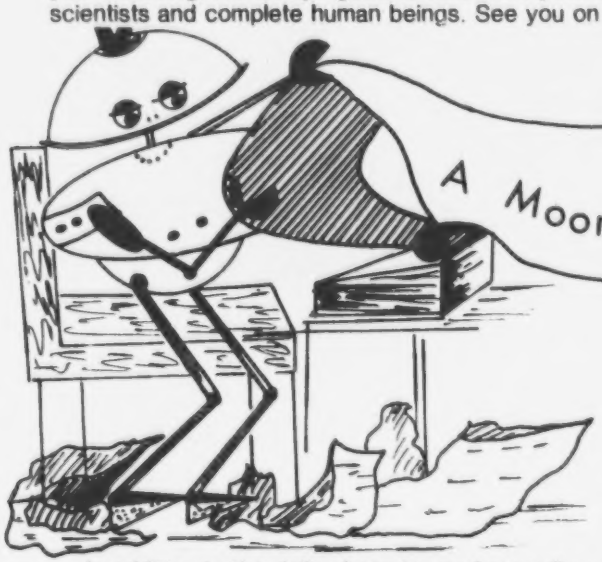
This book, *Young Scientists Explore the Moon*, is written as a result of your comments and suggestions, comments that suggested a need for a handy science book or series of books that contain activity sheets which could be duplicated for students' use. *Young Scientists Explore the Moon* is an attempt to meet this need.

Young Scientists Explore the Moon is one book in a series of books, a series that provides youngsters with a variety of interesting and challenging science-related experiences using puzzles, cutouts, hidden pictures, grids, charts and seek-a-words. Emphasis throughout the series is placed on the development of creativity in the learner. It is hoped that this creativity will be nurtured before, during and after the activities are completed in each book.

It is also hoped that the activity sheets in this book will touch many minds, hearts, and hands and that much personal growth is experienced by all who do the moon exercises. Keep in touch. Let me know how you are doing. It's always good to hear from you. Until then, best wishes in your continued growth as scientists and complete human beings. See you on the moon in the future.

Sincerely,

Jerry DeBruin



When duplicated, the activity sheets in *Young Scientists Explore the Moon* make up an entire student book of moon-related experiences. Youngsters are encouraged to gain firsthand experience by observing the moon daily for at least one month. It is through daily observation of the moon coupled with the immediate recording of its size, shape and position on duplicated activity sheets *each day* that meaningful learning occurs.

In addition to the daily observing and recording of significant findings and feelings at the bottom of each page, students answer numerous questions posed by the lead character, Noom. The text, written in programmed format, facilitates immediate feedback as students uncover correct answers after answering Noom's questions. A record of responses is kept. Teachers are encouraged to take class time each day and have youngsters record their results on the daily and cumulative My Moon Scorecard found on page 27.

You as teachers and parents who use *Young Scientists Explore the Moon* are encouraged to run off activity sheets necessary to make Student Booklets. In addition, copies of pages 29 and 30 can be duplicated as needed and used as student cutouts which are glued to proper locations at the bottom of each page. Pages 1 and 28 are puzzle pages that, when put together and mounted on single-layered cardboard and taped together or put in a 3-ring binder, make up the front and back covers of the Student Booklet (laminated pieces from the covers also make excellent puzzles). Completed activity sheets can then be inserted between these covers or in the binder with the result being a permanent Moon Booklet for each youngster. Each student is encouraged to design and letter his own moon emblem using the blank emblem on the front cover of the Student Booklet. Covers can be laminated for lasting durability.

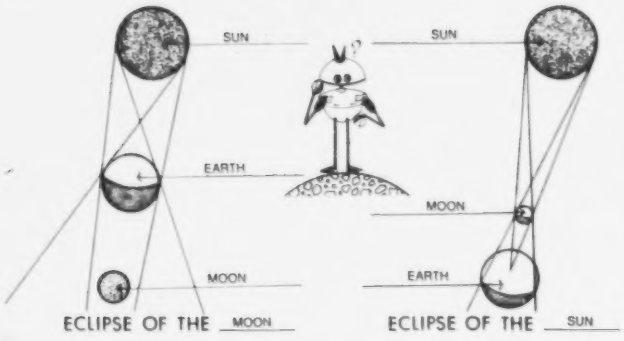
Teachers, parents, and students should note that key astronomical terms are in bold in the text; yellow markers are excellent for coloring in the lighted part of the moon, Central Standard Time is used throughout the book and appropriate prerequisite skills can be utilized with younger children. For example, younger children who have not yet grasped the concept of "degrees above the horizon" can substitute their fists and determine the number of fists that the moon is above the horizon and record this number in the blank marked "degrees" at the bottom of each page.

Answers to questions are found in the text itself. Answers to puzzle pages that make up the front and back covers of the Student Booklet should look like those below. NASA's ranking and answers to the activities Eclipses, My Moon Grid, Moon Walk and Talk, and Planet and Moon TOGETHERNESS are also found below. Good luck in your moon work.

PAGE 1 **Student Booklet** (front cover)

Apollo Emblems

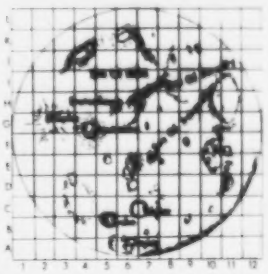
PAGE 23 **Eclipses**



PAGE 24 **WHAT NASA SAYS: Answers to Moon Walk and Talk**

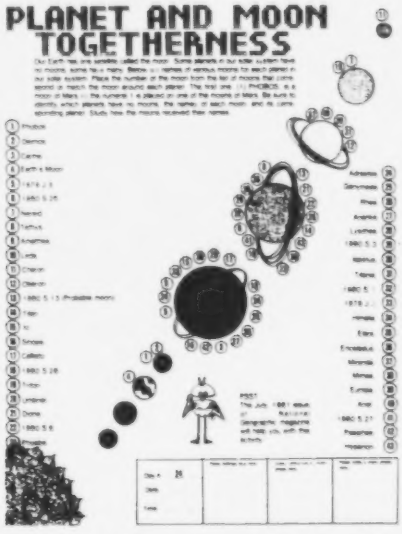
Ranking	Reason for Ranking
15	Little or no use on moon
4	Supply daily food requirements
6	Useful in tying injured together, help in climbing
8	Shelter against sun's rays
13	Useful only if party landed on dark side
11	Self-propulsion devices could be made from them
12	Food, mixed with water for drinking
1	Fills respiration requirement
3	One of principal means of finding directions
9	CO_2 bottles for self-propulsion across chasms
14	Probably no magnetized poles, thus, useless
2	Replenishes loss by sweating
10	Distress call when line of sight possible
7	Oral pills of injection medicine valuable
5	Distress signal transmitter possible communication with mother ship

PAGE 25 **My Moon Grid**



Major Feature	Grid Space	Mare Crater Mountains	Major Feature	Grid Space	Mountains Mare Crater
Copernicus	F4, G4	Crater	Apennines	H6, H7, I7	Mountains
Sea of Rains	I4, I5, I6	Mare	Sea of Serenity	I8, I9, I10	Mare
Sea of Tranquility	F8, G8, G9	Mare	Eratosthenes	H5, H6	Crater
Tycho	B5	Crater	Sea of Fertility	D11,E11,F11	Mare
Kepler	G2	Crater	Walter	C6, C7	Crater
Clavius	A5, A6	Crater	Alpes	K6, K7, J7	Mountains

PAGE 26 **PLANET AND MOON TOGETHERNESS**

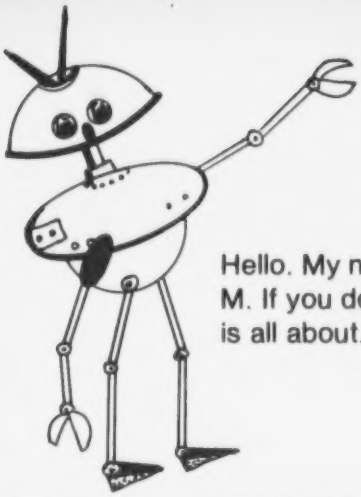


PAGE 28 **Student Booklet** (back cover)

NASA Plaque

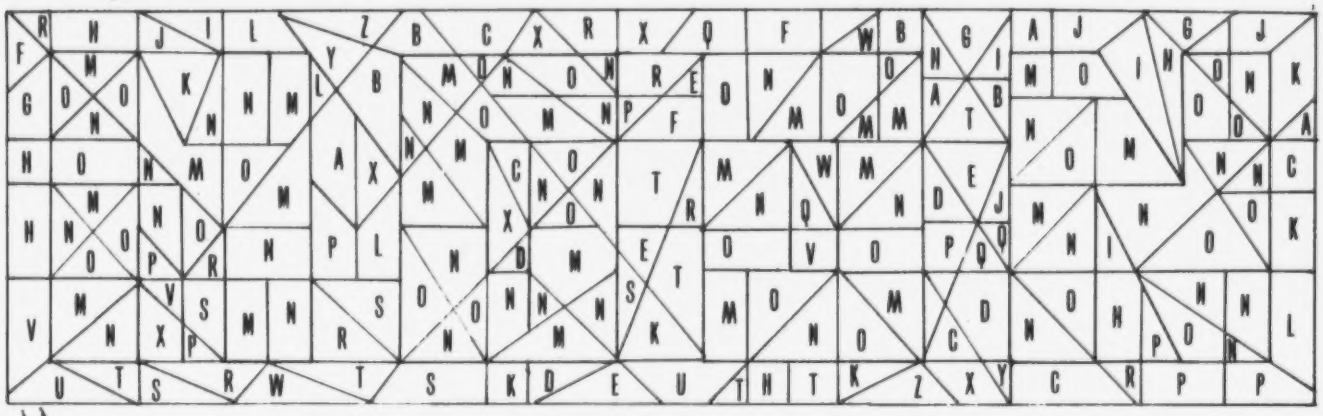
Plaque left on the Moon, July 20, 1969

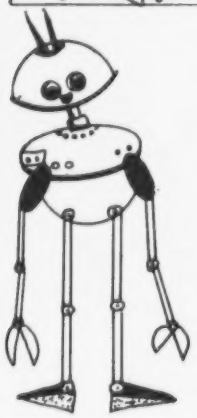
MY VERY OWN
APOLLO 15
SCOTT WORDEN IRWIN
APOLLO 16
YOUNG-MATTINGLY-DUKE
OK
APOLLO IX
MOON EMBLEM
APOLLO
APOLLO XII
Conrad-Gordon-Bean
BY:
APOLLO
APOLLO 11
BIVITT SCOTT SCHWEICK



MEET NOOM

Hello. My name is Noom. Shade in the areas below that are lettered N O O M. If you do this exercise correctly, you will soon *discover* what this book is all about.





Very good. Yes, my name spelled backwards is MOON, and this book is about changes in the moon.

Throughout this book, I will ask you to do experiments related to the moon. I will also ask you to record the eight changes or *phases* that you see in the moon during a single month's time. You can do this at the bottom of each page in this book starting on page three. In box one, record the date and the time during which you *observe* the moon each day or night. Then, in box two, paste a picture that shows your feelings when you observe the moon. These pictures are found on page 29 and can be easily cut out and pasted in box two. In the third box, draw what you think the moon will look like tomorrow. This is your *guess* or *prediction* of what you think the correct phase of the moon will be tomorrow. Paste a picture (cut out from page 30) in the fourth box of how the moon actually looked to you today. Find out if your *prediction* from yesterday was correct or incorrect. Record whether you were correct or incorrect in the appropriate column on My Moon Scorecard found on page 27. Be sure you compute the percent correct, your moon average and your comulative moon average score which is the number correct divided by the total number of days of observation. (Your teacher will help you with these tasks.) Also, add any comments or feelings that you might have at the moment. Of course, there will be days when you are unable to *observe* the moon because of the weather or you may have just forgotten to look. Record what you think the moon might look like anyway. Be sure to look both during the day and at night. Sometimes, the moon fools you.

If you *observe* the moon for one month and paste the appropriate pictures from page 29 and 30 in the boxes at the bottom of each page, you will have a flip book that shows the sequence of the eight phases of the moon as they actually occur. Merely flip the lower right-hand corner of each page with your thumb, and the moon will show its eight phases automatically for you.

Let's do an example below. Put today's date (day number one is marked for you) and *time of observation* in box one like this:

DAY # _____	1
DATE _____	
TIME _____	

Observe the moon. In box two, paste the picture that best describes your feelings when you observe the moon. Remember, these pictures are found on page 29 and can be easily cut out and pasted in this box at the bottom of each page in this book.

PASTE FEELINGS FACE HERE.	2

Draw what you think the moon will look like tomorrow in box three. Remember, this is your *guess* or *prediction* of what you think the moon might look like tomorrow. Name the phase if you can. You may have to look in an encyclopedia under "moon" for background information or consult a book called *An Old Farmer's Almanac.*

DRAW TOMOR-ROW'S MOON PHASE HERE.	3

Observe today's moon. Paste the picture of today's moon phase in box four. These pictures can be found on page 30. Name the phase if you can. Find out if your *guess* or *prediction* was correct or incorrect and record your average and feelings on the My Moon Scorecard on page 27.

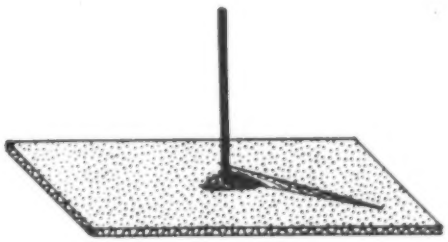
PASTE TODAY'S MOON PHASE HERE.	4

Continue this activity for 27 more days, a full lunar cycle. Fill in the four boxes at the bottom of each page each day. Your flip book of moon phases will then be completed. Below are four boxes for your *observation* and *prediction* of the moon phase for Day #1.

Day # 1 Date _____ Time _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

TELLING TIME

To help you learn about the eight phases of the moon, you will need to learn something about *time*. *Time* involves the relationship between the time on our clocks and the position of the sun in the sky. To us on Earth, the sun *appears* to rise on the eastern *horizon*, travels across the sky in an *arc* and sets on the western *horizon*. You should know that the *horizon* is the line at which the sky meets the earth and an *arc* is part of a *circle*. To learn more about how the sun *appears* to move across the sky, obtain a large sheet of cardboard, a piece of clay, a stick and erasable marker. On a sunny day stand the stick upright in the clay on the cardboard. You have now made a *sundial* much like the one shown below. Mark *East, West, North* and *South* on the *sundial*. Face *South*. Record the time of the day in the chart below. Using your erasable marker, draw the sun's shadow on the cardboard at 30-minute intervals. Measure the length of the sun's shadow at the end of each 30-minute period. Record the length of the sun's shadow in the chart. Place a pebble at the end of the shadow. Note changes in the length of the shadow as time goes by. Then, answer the questions on page 5. To help you find out if your answers are correct, merely place a sheet of paper on the dotted line directly below the question. Fill in your answer to the question in the blank following each question. Move your paper down the page. Uncover the correct answer in the box below the dotted line. This will tell you immediately whether your answer is correct or incorrect. Fill in the number of correct and incorrect answers in the blanks at the end of the exercise on page 5. Be sure to include the *percent* of correct responses.



Time of Day	Length of Shadow in Inches (in.)	Length of Shadow in Centimeters (cm)	Time of Day	Length of Shadow in Inches (in.)	Length of Shadow in Centimeters (cm)

Be sure to observe the moon today and fill in the four boxes below for Day #2.

*If you aren't sure how to measure, cut a strip of paper that matches the length of the sun's shadow. A toothpick that stands upright in a piece of cardboard also makes an excellent sundial.

Day # 2 Date _____ Time _____	Paste feelings face here	Draw tomorrow's moon phase here	Paste today's moon phase here

Action Questions: Remember to cover the correct answer found below the dotted line with a piece of paper. Read question. Write your answer in the blank following the question. Uncover correct answer. Record whether you were correct or incorrect by placing an "x" in the corresponding box following the correct answer. The first one is done for you.

(1)How long in hours is a period of one day? 24 hours

Correct Answer Here	Correct	Incorrect
24 hours	[X]	[ ]

(2) How long, to the nearest hour, is the period from one sunrise to the next sunrise? _____

24 hours	[ ]	[ ]

(3) How long, to the nearest hour, is the period from one sunset to the next sunset? _____

24 hours	[ ]	[ ]

(4) How long, to the nearest hour, is the period from sunrise to the next sunset? _____

12 hours	[ ]	[ ]

(5) How long, to the nearest hour, is the period from sunset to the next sunrise? _____

12 hours	[ ]	[ ]

(6) At about what time would you expect sunrise to occur? _____

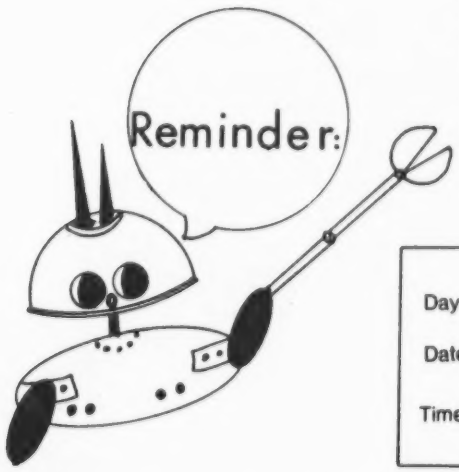
6:00 a.m. C.S.T.	[ ]	[ ]

(7) At about what time would you expect sunset to occur? _____

6:00 p.m. C.S.T.	[ ]	[ ]

(8) How are the length of the sun's shadow and the time of the day related? _____

Sun's shadow longer in early a.m. and late p.m., shorter at noon	[ ]	[ ]



Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

Did you remember to observe the moon today? Record your findings below for Day #3. Record results of your *prediction* on the My Moon Scorecard on page 27. Was your *guess* or *prediction* of what the moon would look like today correct or incorrect? Be sure to write on page 27 any feelings that you have while you *observe* the moon.

Day # 3 Date _____ Time _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

The following questions deal with *time*. Once again, take a piece of paper and match its top edge with the dotted line. Read the question above the dotted line. Write your answer in the blank following the question. Move your paper below the dotted line and uncover the correct answer. Do you agree? Place an "x" in the corresponding box to the right of the correct answer. Keep a record of the number of correct and incorrect responses to the questions and enter your results in the blanks following the exercise.

Let's agree the *sunrise* occurs at 6:00 a.m. and that *sunset* occurs at 6:00 p.m. in the Northern Hemisphere. Answer the timely questions below. You may want to use your sun-dial on page 4 to help you with your task.

(1) If the sun rises in the East at 6:00 a.m. and sets in the West at 6:00 p.m., in what direction would the sun be seen in the middle of its daily trip between sunrise and sunset?

_____

Correct Answer Here: South — Correct [C] Incorrect [I]

(2) What time of day would this be? _____

Noon — [C] [I]

(3) If the sun sets in the West at 6:00 p.m. and rises in the East at 6:00 a.m., would you be able to observe the sun between sunset and sunrise? _____

No — [C] [I]

(4) What time of day would it be if the sun was halfway between sunset and sunrise? ____

Midnight — [C] [I]

(5) About how long does it take the sun from the time it first appears in the East to the time it is seen halfway between sunrise and sunset? _____

6 hours — [C] [I]

(continued on next page)

REMEMBER to fill in your moon observations in the four boxes below. Your moon watching is getting more interesting and complex as each day goes by.

Day # 4 Date _____ Time _____	Paste feelings face here	Draw tomorrow's moon phase here	Paste today's moon phase here

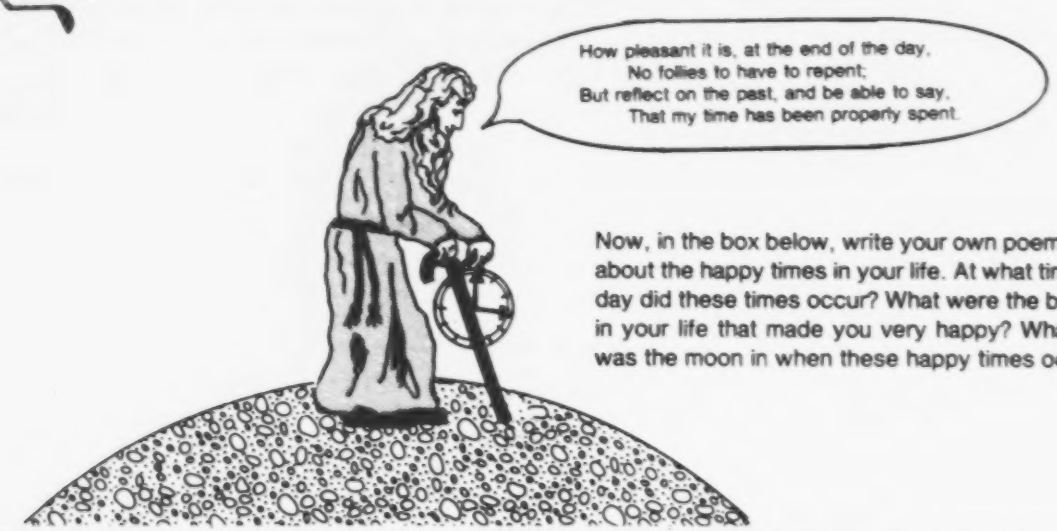
(6) About what time of day would it be when this observation is made? _____

Noon [C] [I]

Thus, you now know that the sun requires 24 hours to make one trip across the sky. *Sunrise* occurs on the eastern *horizon* at about 6:00 a.m., *noon* occurs when the sun is halfway between *sunrise* and *sunset*, *sunset* occurs on the western *horizon* at about 6:00 p.m., while midnight is the time when the sun is halfway between *sunset* and *sunrise*.

Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

SOMETHING TO THINK ABOUT Father Time, using the words of Jane Taylor, gives you something to think about in the following poem:

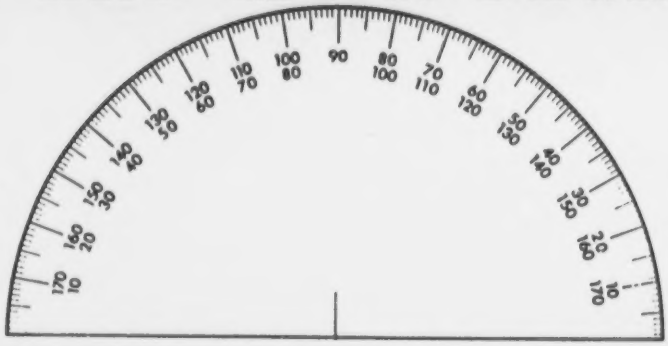

How pleasant it is, at the end of the day,
No follies to have to repent;
But reflect on the past, and be able to say,
That my time has been properly spent.

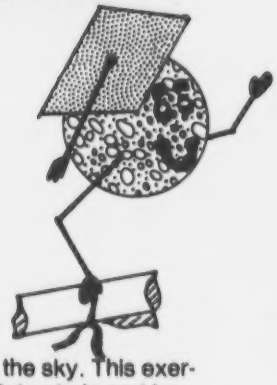
Now, in the box below, write your own poem or story about the happy times in your life. At what time of the day did these times occur? What were the best days in your life that made you very happy? What phase was the moon in when these happy times occurred?

REMINDER: Record your observations for Day #5 in these boxes.

Day # 5 Date _____ Time _____	Paste feelings face here	Draw tomorrow's moon phase here	Paste today's moon phase here

SUN AND MOON DEGREES





You have learned that the sun makes a great *circle* in its *apparent* daily trip across the sky. This exercise will help you learn that there are 360 degrees (parts of a circle) in one complete circle and how these degrees are related to time. You can learn about degrees by using a *protractor.* (Cut out the protractor above, glue protractor to cardboard and answer questions below.) As before, match the top of your paper with the dotted line. Write your answers to the following questions in the blanks below. Uncover the correct answer. Compare your responses to the correct answers and record your results in the blanks following the exercise.

The sun, in its daily path, *appears* to make a great *circle* in the sky.

(1) How many degrees are there in a circle? _____

Correct Answer Here	Correct	Incorrect
360 degrees	C	I

(2) How many degrees does the sun sweep across the sky in going from sunrise to the next sunrise? _____

360 degrees	C	I

(3) How many degrees does the sun sweep across the sky in going from sunrise to sunset? _____

180 degrees or one half of one circle	C	I

(4) How many degrees does the sun sweep across the sky in going from sunset to sunrise? _____

180 degrees or one half of one circle	C	I

(5) How many degrees does the sun sweep across the sky in going from the sunrise position to the noon position? _____

90 degrees or one-fourth of a circle	C	I

(6) How many degrees does the sun sweep across the sky in going from the noon position to the sunset position? _____

90 degrees or one-fourth of a circle	C	I

Continue to observe and record what the moon looks like and how you feel about the moon.

Day # 6 Date _____ Time _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

(continued on next page)

(7) How many degrees does the sun sweep across the sky in going from the noon position to the midnight position? _____

180 degrees or one-half of one circle [C] [I]

(8) How many degrees does the sun sweep across the sky in 24 hours? _____

360 degrees [C] [I]

(9) How many degrees does the sun sweep across the sky in 12 hours? _____

180 degrees [C] [I]

(10) How many degrees does the sun sweep across the sky in 6 hours? _____

90 degrees [C] [I]

(11) How many hours of clock time elapse from 6:00 a.m. to noon? _____

6 hours [C] [I]

(12) How many degrees does the sun sweep across the sky in going from sunrise position to the noon position? _____

90 degrees [C] [I]

(13) How many hours of clock time elapse from 6:00 a.m. to 6:00 p.m.? _____

12 hours [C] [I]

(14) How many degrees does the sun sweep across the sky in going from the sunrise position to the sunset position? _____

180 degrees [C] [I]

(15) How many hours of clock time are there from 6:00 a.m. to midnight? _____

18 hours [C] [I]

(16) How many degrees does the sun sweep across the sky in going from the sunrise position to the midnight position? _____

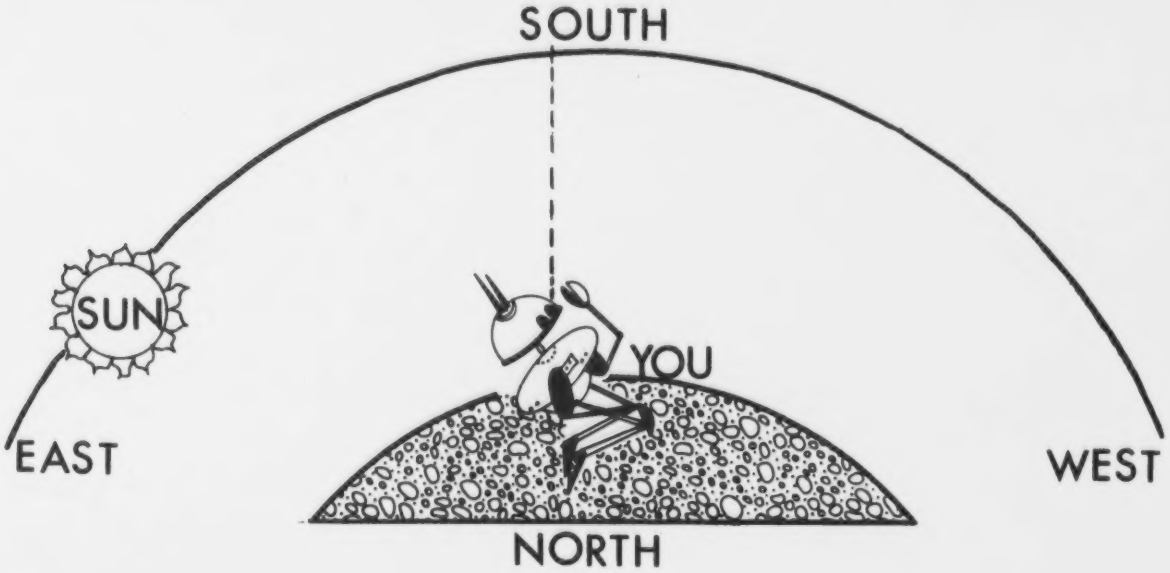
270 degrees [C] [I]

Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

REMINDER: Remember to observe the moon today, which is Day #7. Record your findings in the boxes below. Record your results on the My Moon Scorecard on page 27.

Day # 7 Date _____ Time _____	Paste feelings face here	Draw tomorrow's moon phase here	Paste today's moon phase here

WHERE DO YOU STAND?



The purpose of this activity is to help you relate *clock time* to the position of the sun in the sky. This exercise will also help you find out the number of *degrees* from where you are standing to the moon above the *horizon*. If you face *South, East* is to your left. To your right is the direction *West*. Behind you is the direction *North*. Remember that the sun rises in the *East* and sets in the*West*. It makes a giant *circle* in its *apparent* daily journey across the sky. Knowing this, see if you can answer the following questions. Record your results in the blanks following the exercise.

(1) How far, in degrees and direction, is the sun from its sunrise position on the eastern horizon to its noon position in the southern sky? _____

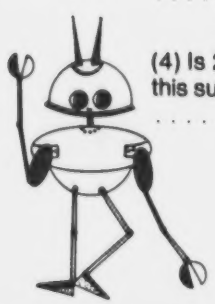
Correct Answer Here	Correct	Incorrect
90 degrees to the West	C	I

(2) How far, in degrees and direction, is the sun from its sunrise position on the eastern horizon to its sunset position on the western horizon? _____

180 degrees to the West	C	I

(3) How far, in degrees and direction, is the sun from its sunrise position to its midnight position? _____

270 degrees to the West	C	I



(4) Is 270 degrees to the right or west of its sunrise position the same as 90 degrees to the left or east of this sunrise position? _____

Yes	C	I

(continued on next page)

OVER one week completed. This is Day #8. Keep up the good work in your observation and recording of the moon's activity.

Day # 8 Date _____ Time _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

(5) At what clock time would the sun be 90 degrees to the east of its noon position? _____

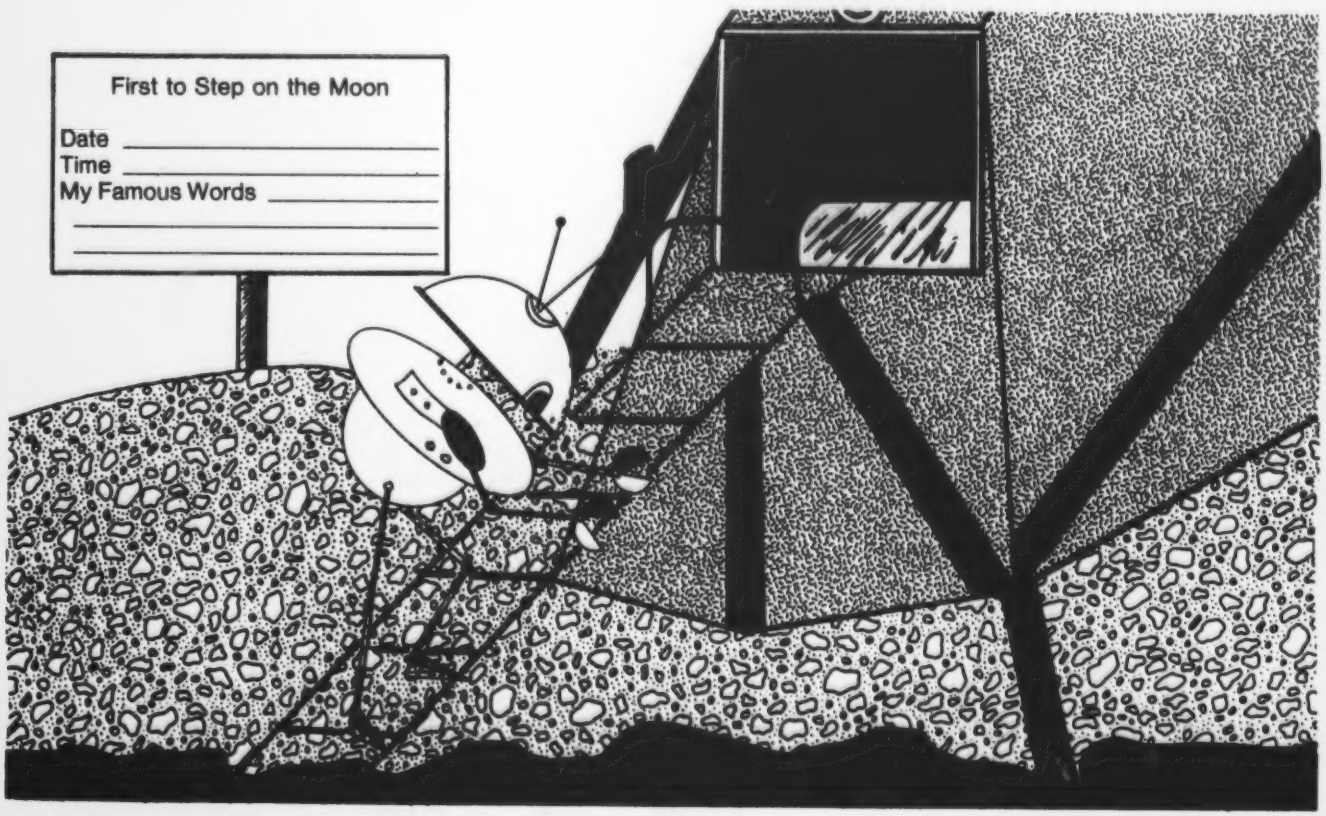
6:00 a.m. Sunrise [C] [I]

(6) At what clock time would the sun be 90 degrees to the west of its noon position? _____

6:00 p.m. Sunset [C] [I]

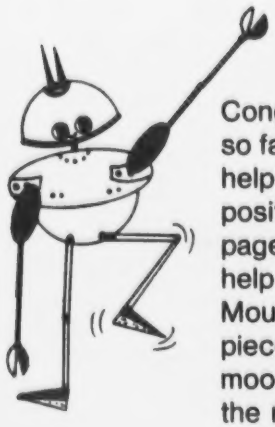
Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

Below is a picture of you and your Lunar Module. You are acting as America's first astronaut to set foot on the moon. Write your name on your space helmet. On the moon plaque below, record the date, time and what your famous words were as you stepped on the moon.



REMINDER: Remember to observe the moon today. Record your findings in the boxes below. Record your results on the My Moon Scorecard on page 27. This is Day #9 already. Time surely flies by rapidly. So does the moon.

Day # 9 Date _____ Time _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

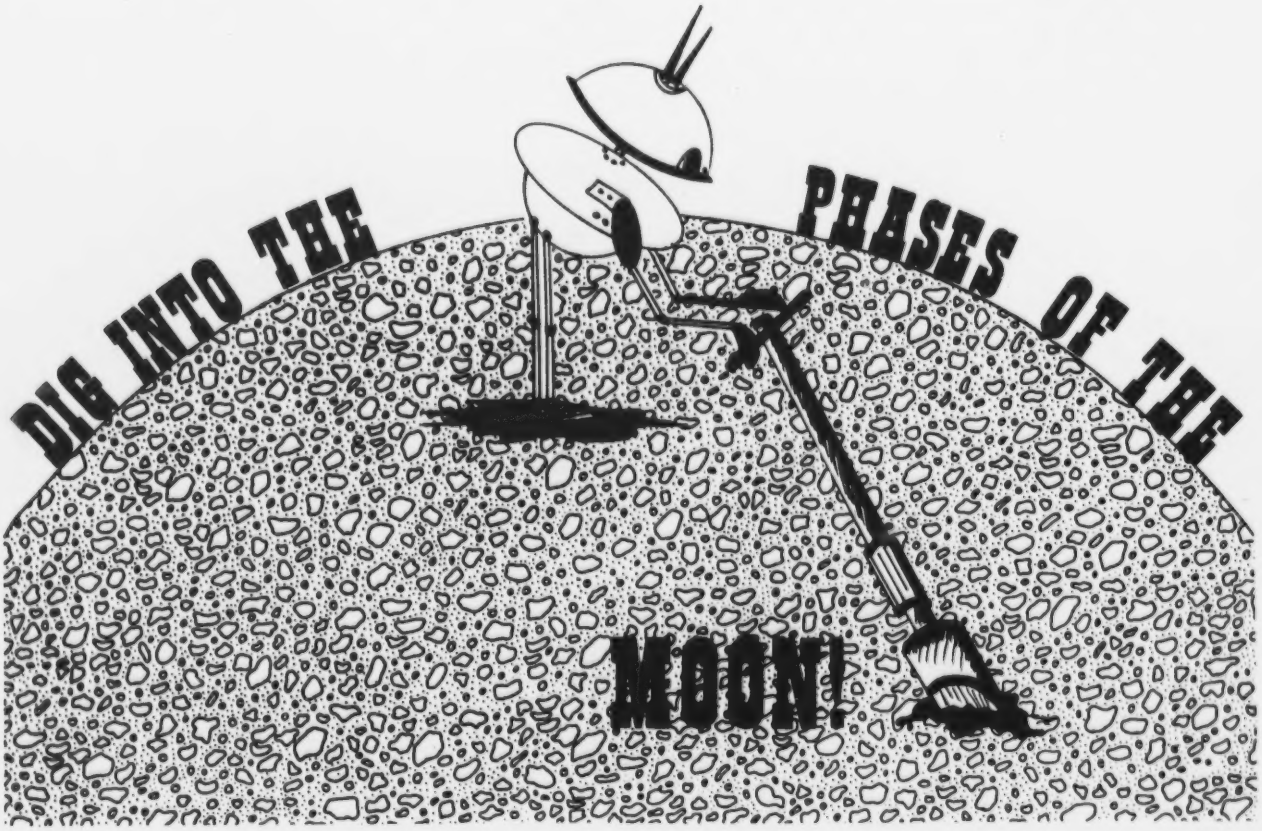


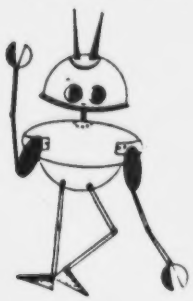
Congratulations, you have set foot on the moon. You have also learned a great deal so far about *time, degrees* and *direction* by using your *protractor.* This exercise will help you see the eight phases of the moon more clearly and will help you chart the position of the moon in the sky. You will need your protractor that you made on page 8, string, soda straw, tape and a nut or washer to build an *astrolabe* which will help you determine the number of *degrees* that the moon is above the *horizon.** Mount your soda straw along the edge of the protractor as shown below. Hang a piece of string with a nut or washer attached to the center of the astrolabe. Sight moon through straw. Press string against astrolabe with thumb and forefinger. Read the number of degrees on your astrolabe that the moon is above the horizon. *Be sure to subtract from 90 degrees because you are using the protractor upside down.* Record the number of degrees in the *first box* below on this page. Also, include today's date and the time that you made your observation. Keep a record of your findings and feelings.

REMINDER: Continue to observe the moon today. Be sure to fill in the number of *degrees* that the moon is above the *horizon* in the first box below. Record other findings. Remember to record your results on the My Moon Scorecard on page 27.

Day # 10 Date _____ Time _____ # of Degrees_____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

*You can also use your protractor to find out, in degrees, how steep a hill is.





Now that you have learned how to find the number of *degrees* that the moon is above the *horizon* and have located and landed on the moon, you can begin your moon diggings. On the next page, you will learn that the *sun* lights up the moon. You will also be able to better *predict* the position of the sun in the sky and the corresponding phase of the moon. The My Moon Scorecard average should zoom upwards as a result of this exercise.

For our purposes, we will now assume that the sun stays in one place at the center of our *universe.* The earth *rotates* on its *axis* and the moon *revolves* around the earth. Answer the questions on page14. Record the number of correct and incorrect responses and the percent of correct responses in the blanks following the exercise. Once again, match a blank piece of paper with the dotted line. Answer the questions in the blank following each of the questions. Uncover the answer below the dotted line. Find out if you were correct or incorrect. Good luck in your moon diggings.

PSST:
Be sure to observe the moon today and record your findings and feelings.

Day # 11 Date _____ Time _____ # of Degrees _____	Paste feelings face here.	Paste today's moon phase here.	Draw tomorrow's moon phase here.

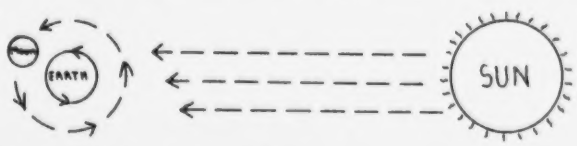
(1) Of the sun, moon and earth, which has a *motion* or *movement* that closely resembles that of a spinning top? _____

Correct Answer Here: Earth — Correct [C] — Incorrect [I]

(2) Of the sun, moon and earth, which one travels in a *circle* around the earth? ____

Moon [C] [I]

(3) A picture of the earth and the moon might look like this. Be sure to look along the arrows for help.



Both the moon and the earth travel around the _____ .

Sun [C] [I]

(4) Look at the hands on a clock. They travel in a *clockwise* direction. When you look at the moon, earth and sun from a point in space, which term, clockwise or counterclockwise, best describes the *rotation* of the earth on its *axis*? _____

Counterclockwise [C] [I]

(5) When viewed from this point in space, which term, clockwise or counterclockwise, best describes the *revolution* of the moon about the earth? ____

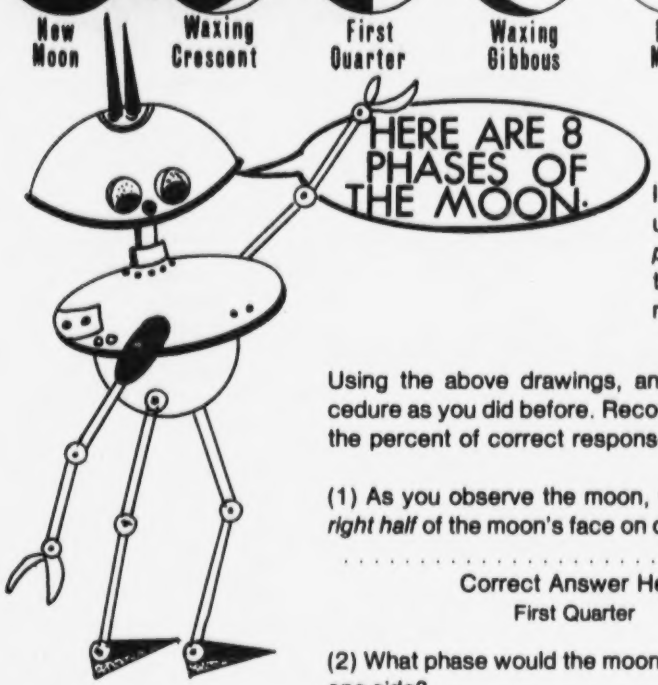
Counterclockwise [C] [I]

Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

In the space below, write about what would happen if the earth rotated *clockwise* on its axis instead of *counterclockwise*. What would happen to the earth's winds and weather patterns?

REMINDER: Be sure to observe the moon today. Fill in the results of your observations in the boxes.

Day # 12 Date _____ Time _____ # of Degrees_____	Paste feelings face here	Draw tomorrow's moon phase here	Paste today's moon phase here.



In the previous exercise, you learned that the sun lights up the moon and that the moon changes its *shape* and *position* in the sky a great deal in one month's time. In this exercise you will observe all eight phases of the moon during its monthly lunar cycle.

Using the above drawings, answer the following questions. Follow the same procedure as you did before. Record your correct and incorrect responses and determine the percent of correct responses in the blanks following the exercise.

(1) As you observe the moon, what phase would the moon be in if the *sun* lit up the *right half* of the moon's face on one side? _____

Correct Answer Here	Correct	Incorrect
First Quarter	C	I

(2) What phase would the moon be in if the *sun* lit up the *left half* of the moon's face on one side? _____

Last Quarter	C	I

(3) What phase would the moon be in if the *sun* lit up the *entire face* of the moon on one side? _____

Full Moon	C	I

(4) What phase would the moon be in if the *sun* did *not* light up any of the moon's face on one side? _____

New Moon	C	I

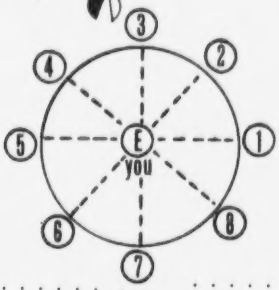
Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

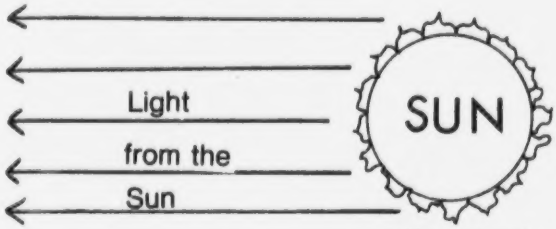
REMINDER: Observing the moon is a very interesting experience. Be sure to fill in the boxes below. Remember to chart the number of degrees that the moon is above the horizon by using your *astrolabe*. By tomorrow, you will have completed two weeks of moonwatching and digging.

Day # 13 Date _____ Time _____ # of Degrees _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

DARKEN ME

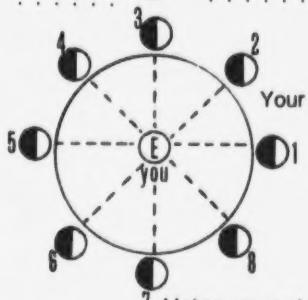
From the previous exercises you know that the *sun* lights up the moon and that there are eight *phases* of the moon. This exercise will help you find out which part of the moon receives light from the sun at any one time. With a pencil or pen, blacken in the half of the moon that does *not* receive light in the pictures below. Then, uncover the correct answer below the dotted line. Remember, only that half of the moon that faces the sun actually receives sunlight.

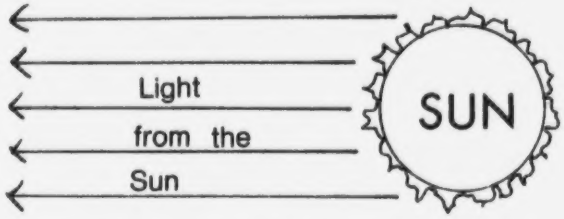




(Far, faraway)

Your picture should look like this:





(Far, faraway)

Using your pictures above, imagine yourself being on the earth looking at the moon. You see along the *dotted* lines from the *earth* outward.

(1) If you looked at the moon when it was in position #1, would you be looking at the *dark* side, the lit up side, or *half* of the dark side *and half* of the lit up side? _____

Correct Answer Here	Correct	Incorrect
Dark Side	C	I

(2) If you looked at the moon when it was at position #3, would you see the *dark* side, the lit up side, or *half* of the dark side *and half* of the lit up side? _____

Half the Dark Side, Half the Lit Side	C	I

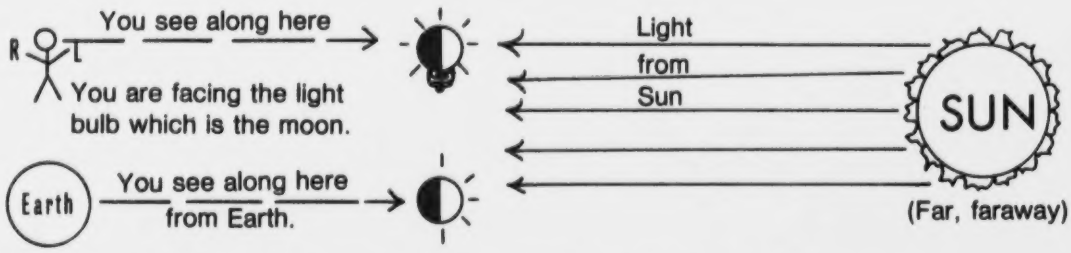
Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

REMINDER: Remember to observe the moon tonight and record your results in the boxes below. You have reached the halfway mark in the lunar cycle. GOOD WORK!

Day # 14 Date _____ Time _____ # of Degrees_____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

YOU LIGHT UP MY LIFE!

You can tell which phase the moon is in by imagining that the moon is like a light bulb, half of which is painted black, the dark side, and half of which is normal, the lit up side. Now, look at the picture below. The letters "R" and "L" stand for your right hand and your left hand. Answer the following questions. Record your answers in the blanks following the questions just as you did below.



(1) When we "see" the moon like this in its *dark side phase*, what phase is the moon in? _____
(You may want to look at page 16 to help you answer this question.)

Correct Answer Here	Correct	Incorrect
New Moon	C	I

(2) When the moon is in *new moon phase*, where is the sun with respect to you on earth and the moon?

_____

In back of the moon or the moon is between the earth and the sun but not at the same level.	C	I

(3) When you look at the moon like this and see the right-hand side lit up and the left hand side dark, or you see it as an object which has this shape ◐ , what phase is the moon in? _____

First Quarter	C	I

(4)When the moon is in First Quarter, where is the sun with respect to you on the earth and the moon?

_____

To the right of where I saw the moon or it's 90° to the right or west of where I saw the moon	C	I

(5) If you looked at the moon when it was at position #5 on page 16, would you see the *dark* side, the lit up side, or *half* of the dark side and *half* of the lit up side? _____

Lit up side	C	I

Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

REMINDER: Keep observing the moon. Record any changes in its size, shape or position. Remember to record the number of degrees that the moon is above the horizon. Add your feelings, also.

Day # 15 Date _____ Time _____ # of Degrees _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

YOU LIGHT UP MY LIFE AGAIN!

Continue your work below by using the moon diagrams found on pages 16 and 17 to help you with your task.

(1) When we see the moon with its entire face lit up, what phase is the moon in? _____

Correct Answer Here	Correct	Incorrect
Full Moon	C	I

(2) When the moon is full, where is the sun with respect to the moon and you on the earth? _____

Earth is between the moon and the sun, or the sun is 180° from where the moon is located but not at the same level.	C	I

(3) If you looked at the moon when it was at position #7 on page 16, would you see the dark side, the lit up side or half and half? _____

Half the dark side Half the lit up side	C	I

(4) When you *observe* the moon like this with the left-hand side lit up and the right-hand side dark or as an object which has this shape ◑ , what phase is the moon in? _____

Last Quarter	C	I

(5) When the moon is in the Last Quarter phase, where is the sun with respect to the earth and moon? _____

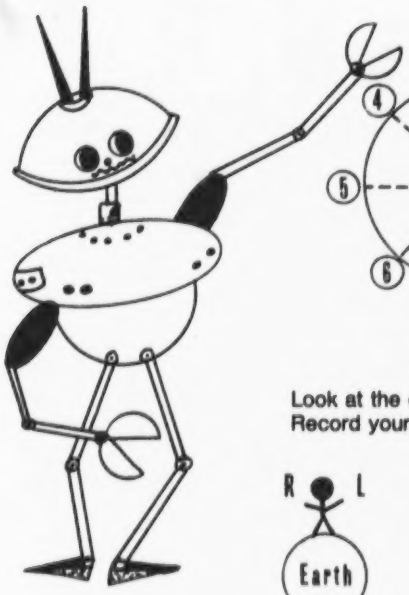
To the left of where I saw the moon or it's 90° to the left or east of where I saw the moon.	C	I

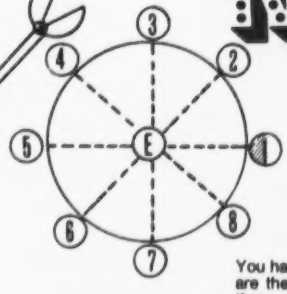
Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

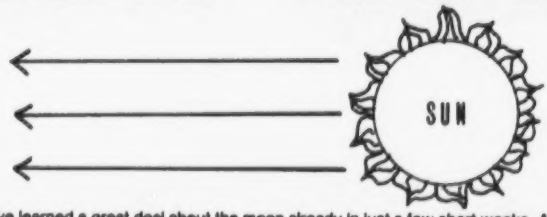
REMINDER: Remember to observe the moon tonight and record your results in the boxes below. Be sure to chart your average on the My Moon Scorecard on page 27. Find your cumulative moon average by dividing the number of correct predictions by the total number of predictions made.

Day # 16 Date _____ Time _____ # of Degrees_____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

NEW MOON

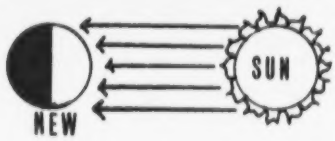






You have learned a great deal about the moon already in just a few short weeks. Above are the same pictures of the moon at various positions in the sky. You already used these pictures on page 16. Darken in the parts of the 8 circles above where the moon cannot be seen. If you need help, see page 16.

Look at the diagram below and answer the following questions.
Record your results in the blanks following the exercise.



(1) In your own words, what is the relationship between the *position* of *New Moon* and the sun? _____

Correct Answer Here	Correct	Incorrect
New moon and sun are in same part of sky	C	I

(2) If the sun was just rising in the *east*, where would the *New* Moon be found? _____

Rising in the east with the sun	C	I

(3) If the New Moon was setting in the *west*, about what time of day would it be? _____

6:00 p.m. C.S.T.	C	I

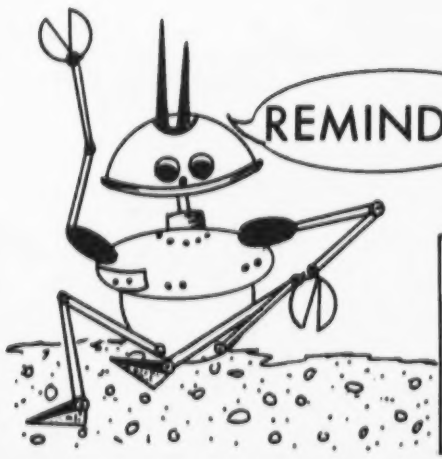
HINT: You should remember that the New Moon and the sun are in the same area of the sky. Hence, when the New Moon is setting, so is the sun. Sunset occurs around 6:00 p.m. in the evening.

(4) Could you view the New Moon at midnight? _____

No	C	I

Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

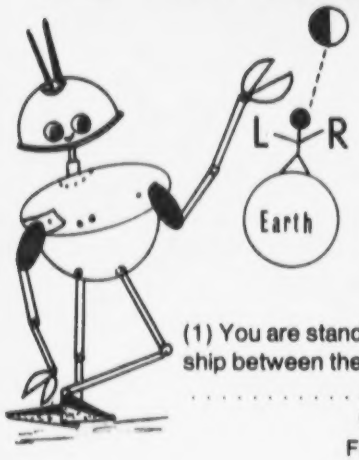
FEELINGS

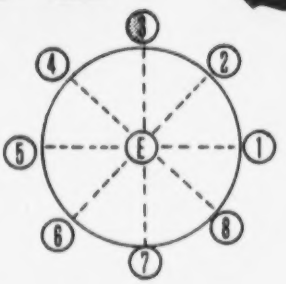


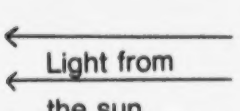
You are well on your way to a complete lunar cycle. Keep up the good work. How do you feel about your accomplishments thus far?

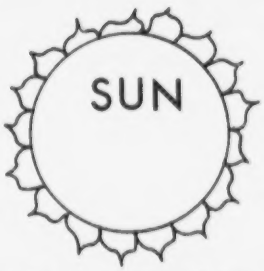
Day # 17 Date _____ Time _____ # of Degrees _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

FIRST QUARTER









(1) You are standing on the earth above and are facing south. In your own words, what is the relationship between the position of a First Quarter moon and the sun? _____

Correct Answer Here	Correct	Incorrect
First Quarter is 90° to the left or east of the sun.	C	I

(2) If the sun was just setting on the *western horizon*, where would the First Quarter moon be observed? _____

South of a point directly above me or 90° to the left or east of the setting sun.	C	I

(3) If the First Quarter moon was observed at noon, in what part of the sky would it be found? _____

Rising in the east or 90° to the left or east of the sun.	C	I

(4) At what time would a First Quarter moon be setting in the west? _____

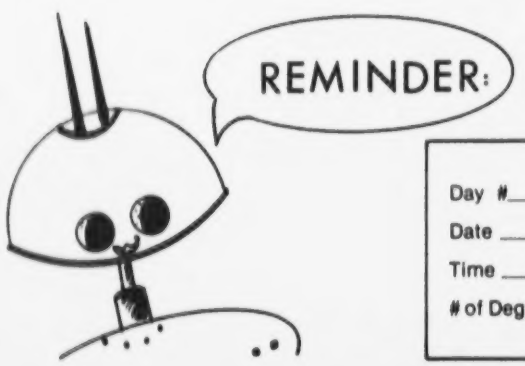
Midnight	C	I

HINT: You should remember that the *sun* is 90° to the *west* or *right* of First Quarter Moon.

(5) Between what clock times would the moon at First Quarter *not* be seen? _____

Between midnight and noon	C	I

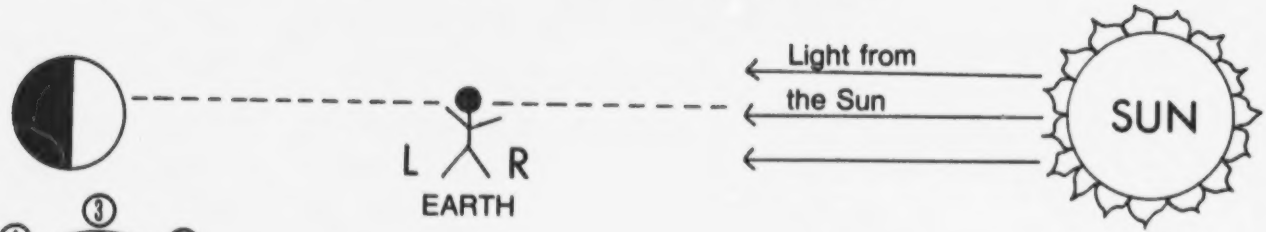
Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

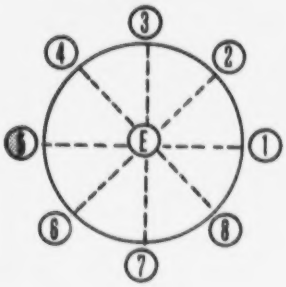


You have nearly three weeks of observation completed. Continue your good work.

Day # 18 Date _____ Time _____ # of Degrees_____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

FULL MOON





(1) You are standing on the earth, looking directly at the full moon. In your own words, describe the relationship between the position of the sun and the *Full Moon:* _____

Correct Answer Here	Correct	Incorrect
Sun is directly opposite the Full Moon or 180° from Full Moon	C	I

(2) If the sun was just rising in the east, where could you see the Full Moon? _____

Setting in the West	C	I

(3) Could the Full Moon be seen at midnight? _____

Yes	C	I

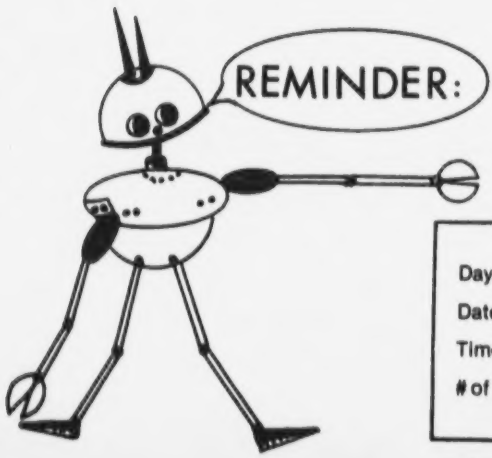
(4) In what part of the sky would the Full Moon be seen at midnight? _____

South of a point directly above me or 180° from the setting sun	C	I

(5) At about what time would a Full Moon be seen rising on the eastern *horizon*? _____

6:00 p.m. Sunset	C	I

Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____



Fill in the boxes below and record your results for each day during the next week.

Day # 19 Date _____ Time _____ # of Degrees_____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

LAST QUARTER

(1) You are standing on the earth in space and observe the left half of the moon lit up. In your own words, tell what the relationship is between the position of the sun and a Last Quarter moon? _____

Correct Answer Here	Correct	Incorrect
Sun is 90° to the left or east, or the last Quarter Moon is 90° west of the sun.	C	I

(2) If the clock time was noon, where could a Last Quarter moon be observed? _____

Setting in the west	C	I

(3) If a Last Quarter moon was rising in the east, what time would it be? _____

Midnight	C	I

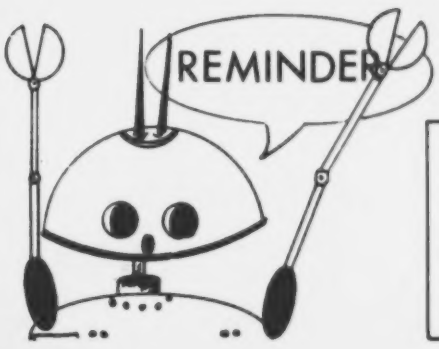
(4) Between what clock time would the moon at Last Quarter phase *not* be seen? _____

Between noon and Midnight	C	I

Number of Correct Responses in this Exercise _____
Number of Incorrect Responses in this Exercise _____
Percent of Correct Responses in this Exercise _____

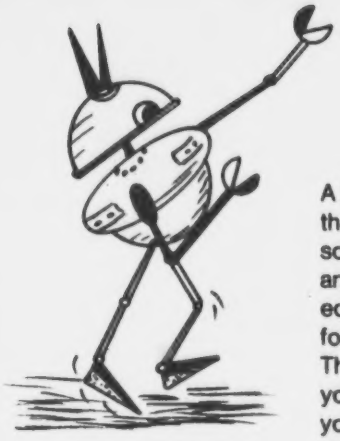
THE MOON

The new moon always rises at sunrise
And the First Quarter at noon.
The full moon always rises at sunset
And the Last Quarter at midnight.



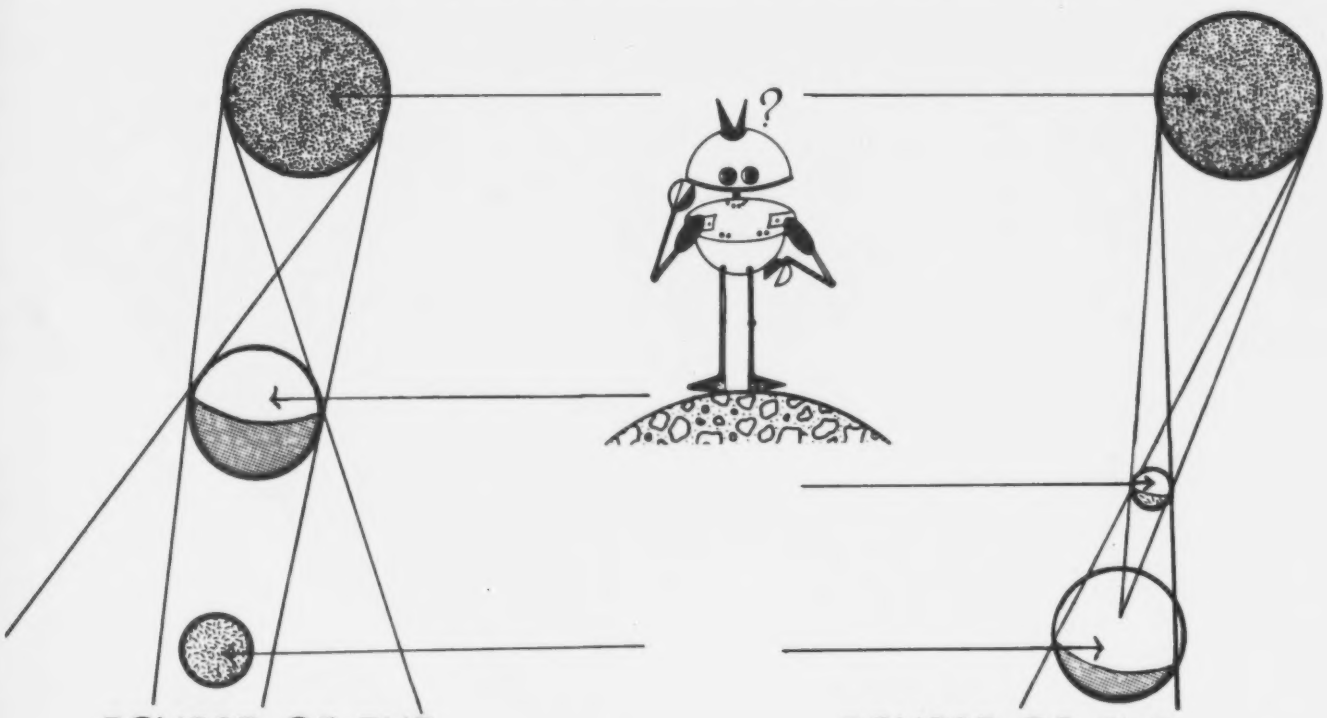
Keep a careful watch for the moon. You now have completed a full cycle of the moon by doing the *written* exercises in this book. You have completed *20 of 28 days* in a full lunar cycle by recording your observations in the boxes at the bottom of each page. This book contains enough pages for 24 of 28 lunar observations. Design four sheets of your own and complete the full 28-day lunar cycle. This will complete your flip book. The above poem will also help you with your study. Congratulations, moon person; here are some more moon activities.

Day # 20 Date _____ Time _____ # of Degrees _____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.



ECLIPSES

A lunar (moon) eclipse occurs when the *moon* passes into the huge cone-shaped shadow that the earth casts into space. Thus, the earth gets between the sun and the moon. A solar (sun) eclipse, however, occurs when the moon gets between the earth and the sun and casts a shadow on the earth. Below are two drawings that show both a lunar and solar eclipse. Print the names "Sun," "Moon" and "Earth" in the blanks that show the position for an eclipse. With a pencil or pen, shade in the cone-shaped shadows for each eclipse. Then, name each eclipse. Remember that you can look directly at a lunar eclipse with your eyes, binoculars, and telescopes but you should *never* view a solar eclipse unless you have special glasses or your teacher or parents help you set up a special indirect viewing box. Answer the questions below and record your responses.



ECLIPSE OF THE _____ ECLIPSE OF THE _____

(1) In what phase must the moon be in for an eclipse of the sun to occur? _____

Correct Answer Here	Correct	Incorrect
New	C	I

(2) In what phase must the moon be in for an eclipse of the moon to occur? _____

Full	C	I

Number of Correct Responses in this Exercise _____

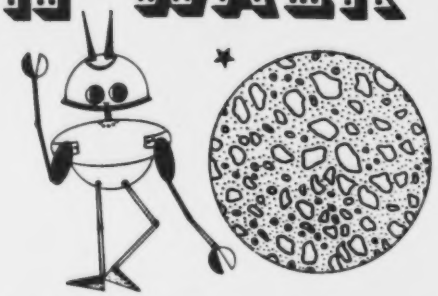
Number of Incorrect Responses in this Exercise _____

Percent of Correct Responses in this Exercise _____

PSST: When will the next lunar and solar eclipses occur?

Day # 21 Date _____ Time _____ # of Degrees_____	Paste feelings face here.	Draw tomorrow's moon phase here.	Paste today's moon phase here.

MOON WALK AND TALK



You are a member of the moon space shuttle crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles (320 km) from the rendezvous point. During reentry and landing, much of the equipment including tiles were damaged, and because survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile (320 km) trip. On this sheet of paper are listed the fifteen items left intact and undamaged after landing. Your task is to rank order them in terms of their importance for your crew in allowing them to reach the rendezvous point. Place the number 1 by the most important and so on through 15, the least important. Then, have your parents help you with the rankings. Record your responses in the "Parents and My Ranking" column. Ask your teacher for the NASA rankings. Compare the differences between you, your parents and NASA rankings.

Undamaged Items	My Ranking	Parents and My Ranking	NASA Ranking	My Difference from NASA	Parents and My Difference from NASA
Box of matches					
Food concentrates					
50 ft. of nylon rope					
Parachute silk					
Portable heating unit					
Two 45-calibre pistols					
1 case of dehydrated milk					
2 100-lb. tanks of oxygen					
Stellar map (of moon's constellations)					
Life raft					
Magnetic compass					
5 gallons of water					
Signal flares					
First aid kit containing injection needles					
Solar powered FM receiver-transmitter					

My Total Difference from NASA Is _____.

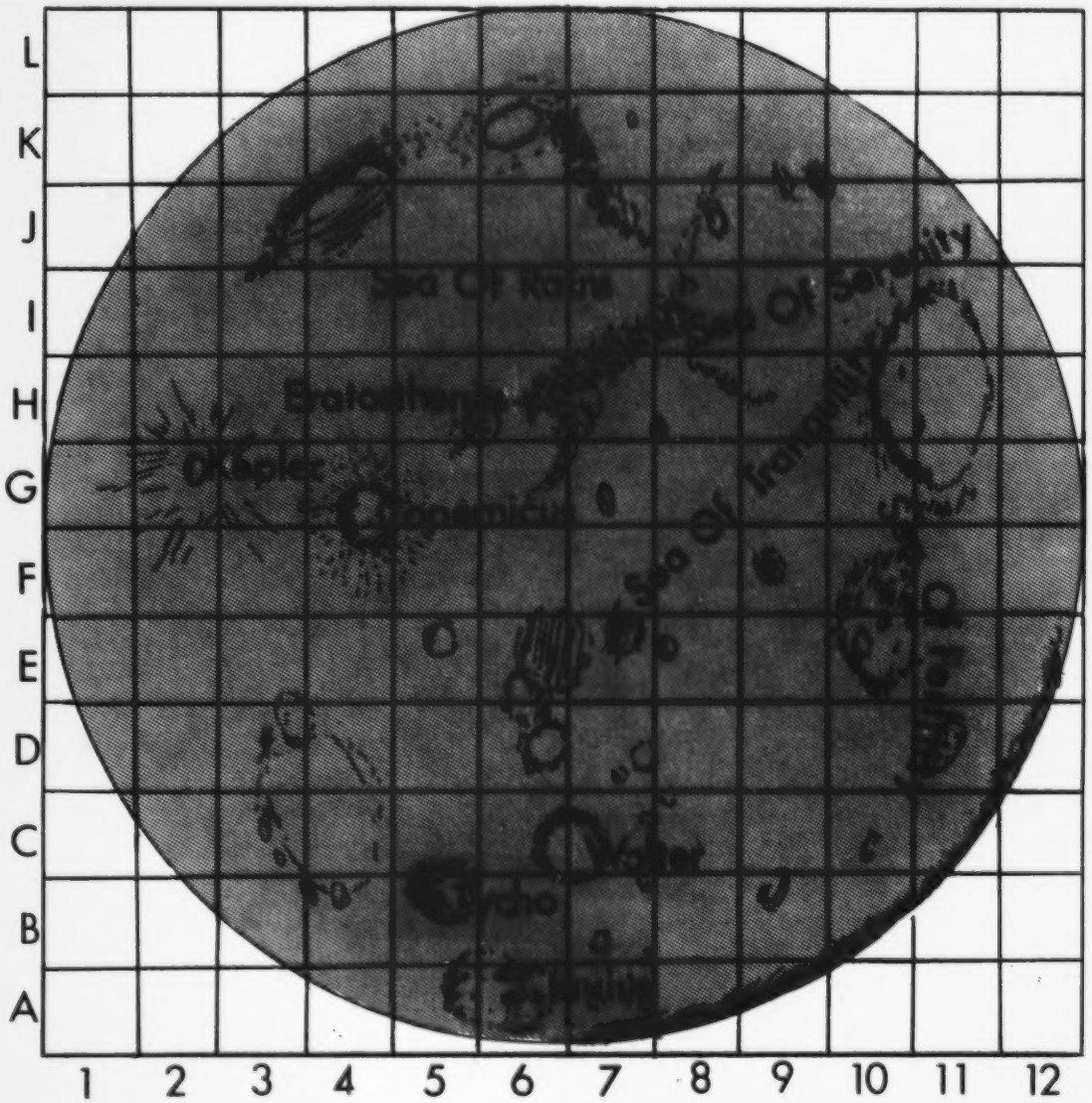
Parents and My Total Difference from NASA Is _____.

For further moon walking information, contact: National Aeronautics & Space Administration Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44135

Day # 22 Date _____ Time _____ # of Degrees_____	Paste feelings face here	Draw tomorrow's moon phase here	Paste today's moon phase here

MY MOON GRID

Below is a picture of the moon that contains grid lines. Identify the grid space of each major feature listed in the chart below. Place the name of the grid space in the chart opposite that feature. Then, identify whether that moon feature is a mare, crater or mountain.



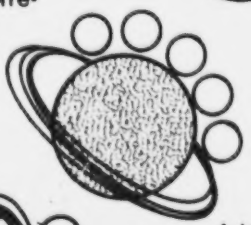
Major Feature	Grid Space	Mare/Crater/Mountains	Major Feature	Grid Space	Mountains/Mare/Crater
Copernicus			Apenninus		
Sea of Rains			Sea of Serenity		
Sea of Tranquility			Eratosthenes		
Tycho			Sea of Fertility		
Kepler			Walter		
Clavius			Alpes		

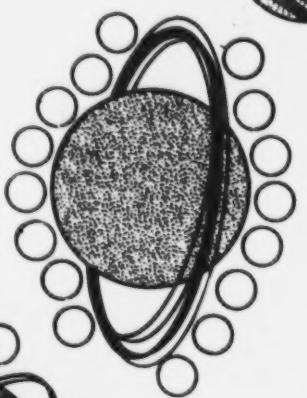
PSST: Be sure to look up the word *mare* in your science book or dictionary.

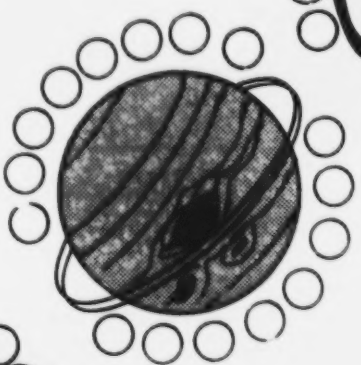
	Paste feelings face here	Draw tomorrow's moon phase here	Paste today's moon phase here
Day # 23 Date _____ Time _____ # of Degrees_____			

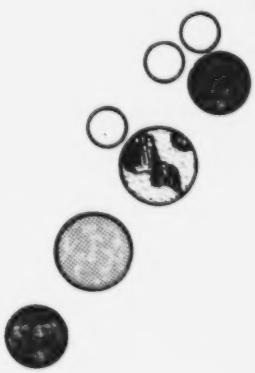
PLANET AND MOON TOGETHERNESS

Our Earth has one satellite called the moon. Some planets in our solar system have no moons, some have many. Below are names of various moons for each planet in our solar system. Place the number of the moon from the list of moons that correspond or match the moon around each planet. The first one, (1) PHOBOS, is a moon of Mars so the numeral 1 is placed on one of the moons of Mars. Be sure to identify which planets have no moons, the names of each moon, and its corresponding planet. Study how the moons received their names.









1. Phobos
2. Deimos
3. Carme
4. Earth's Moon
5. 1979 J 3
6. 1980 S 26
7. Nereid
8. Tethys
9. Amalthea
10. Leda
11. Charon
12. Oberon
13. 1980 S 13 (Probable moon)
14. Titan
15. Io
16. Sinope
17. Callisto
18. 1980 S 28
19. Triton
20. Umbriel
21. Dione
22. 1980 S 6
23. Phoebe

24. Adrastea
25. Ganymede
26. Rhea
27. Ananke
28. Lysithea
29. 1980 S 3
30. Iapetus
31. Titania
32. 1980 S 1
33. 1979 J 2
34. Himalia
35. Elara
36. Enceladus
37. Miranda
38. Mimas
39. Europa
40. Ariel
41. 1980 S 27
42. Pasiphae
43. Hyperion

PSST:
The *July*, 1981 issue of *National Geographic* magazine will help you with this activity.

Day # 24 Date _____ Time _____ # of Degrees_____	Paste feelings face here	Draw tomorrow's moon phase here	Paste today's moon phase here

MY MOON SCORECARD

Day #	Mark "1" if previous day's prediction was correct.	Mark "1" if previous day's prediction was incorrect.	Percent correct per day either 0% or 100%	Moon average per day either 1000 or 000	Cumulative moon average (divide no. correct by total days observed	Comments and Feelings
1	1	0	100%	1000	1000	
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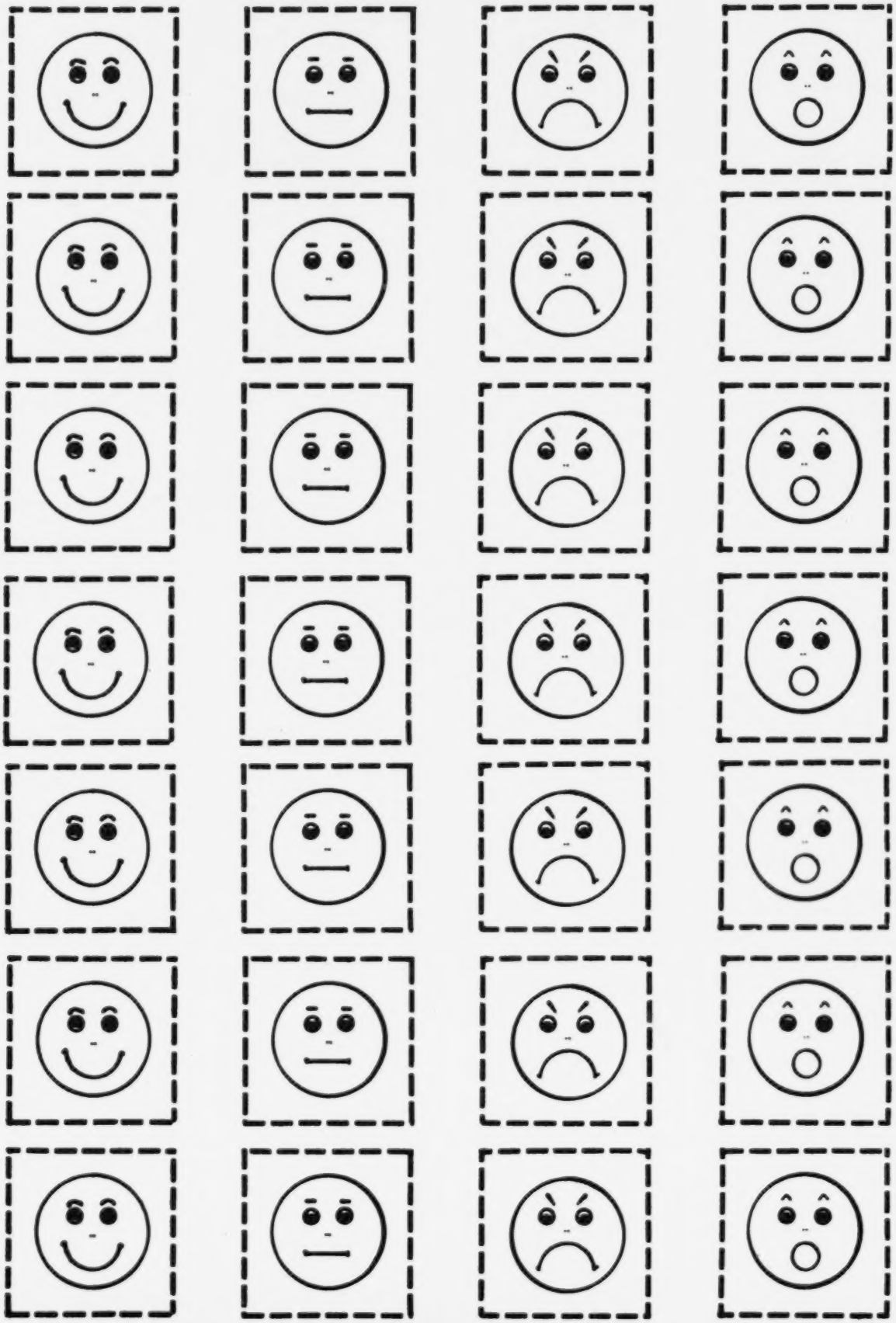
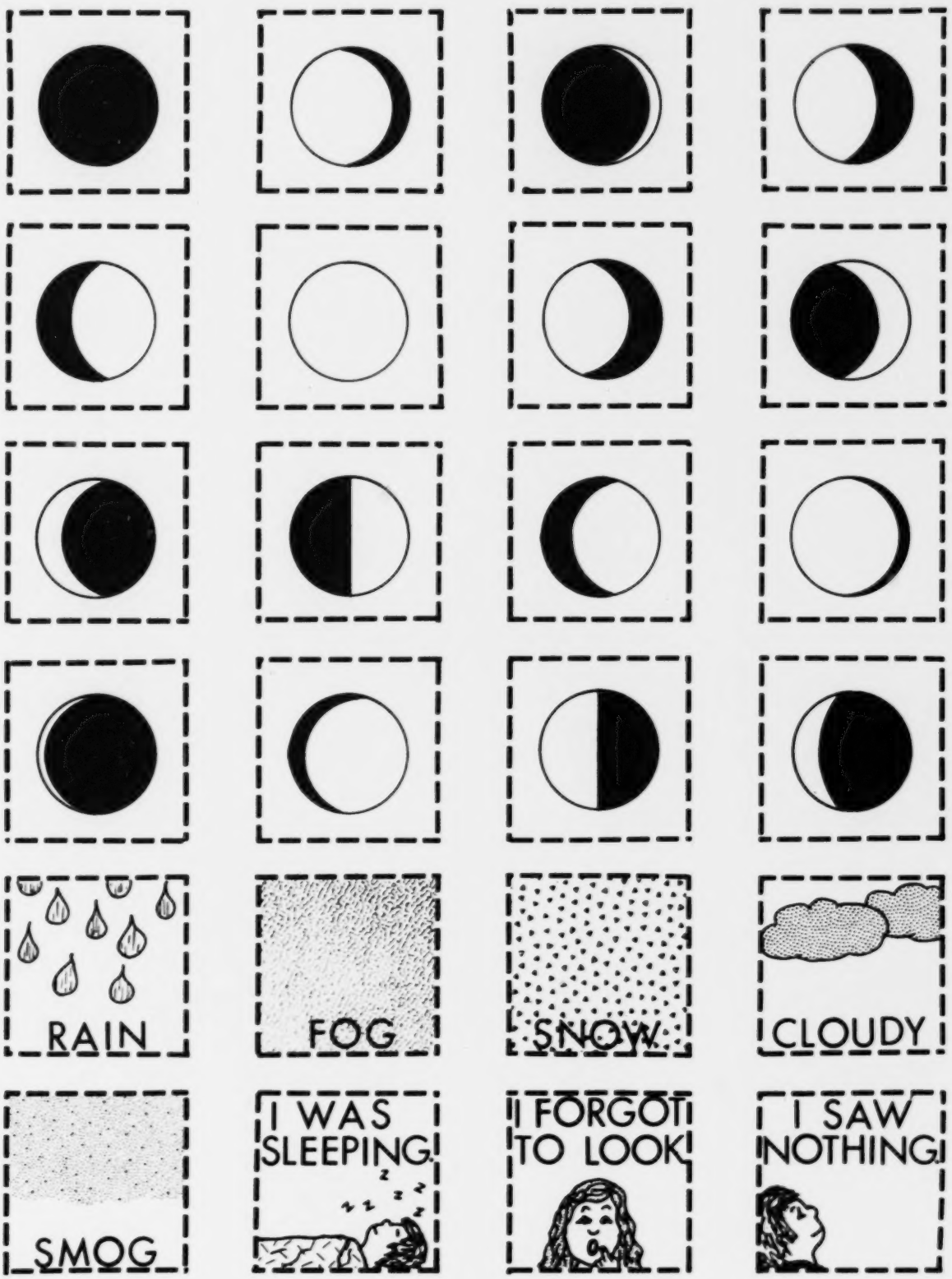
MY MOON FEELINGS



MY MOON PHASES



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